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X. APPENDIX B
PHASE 2 STUDY GROUP ANNOTATED BRIEFING

JOINT DOD-DOE PHASE 2 STUDY OF EARTH PENETRATOR WEAPONS (U)

- - INTERIM CAPABILITY REPORT - -

MAJ. JAMES M. LEONARD, AFWL

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CONTAINS CONTRACTOR
PROPRIETARY INFORMATION

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BRIEFING OUTLINE

(U) The Department of Defense (DOD) has directed the study of Earth Penetrator Weapons (EPWs) and has formally asked the Department of Energy (DOE) to participate. The DOE formally accepted and a joint phase 2 study group, consisting of several agencies from within both Departments, was formed to carry out this task.

(U) The outline shown here highlights the main areas of this annotated briefing, which addresses the quick-look status of the phase 2 at the four-month point.

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**REQUESTED DOD INPUT TO SUPPORT
PHASE 2 STUDY (U)**

UNDER SECRETARY OF DEFENSE (POLICY)

DoD
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DEFENSE NUCLEAR AGENCY

- (U) LED THE EFFORT TO DEVELOP WEAPON EFFECTS MODELS

DEFENSE INTELLIGENCE AGENCY

- (U) PROVIDED VALIDATED, GENERIC TARGET SET

DoD
b(1)
(3)

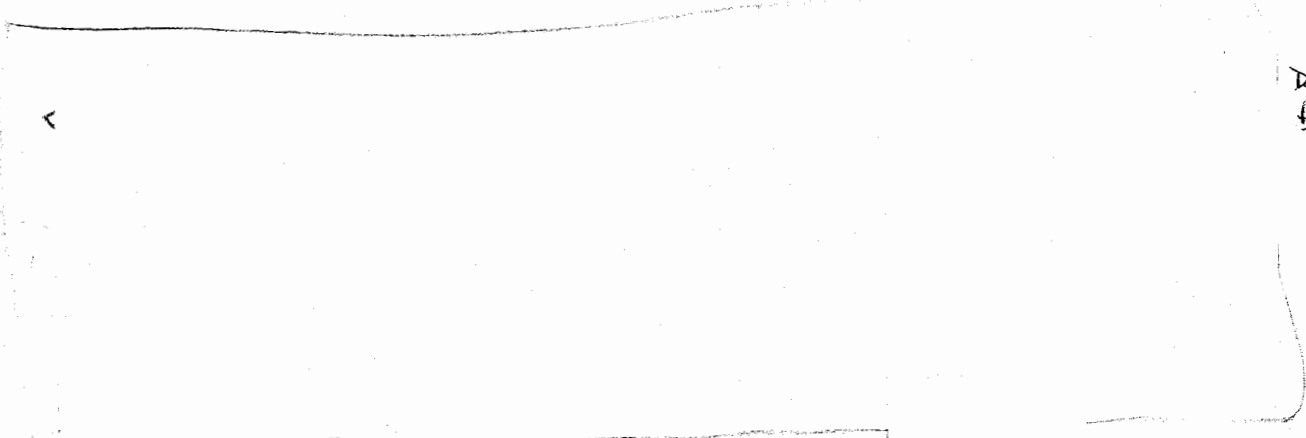
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(2) (U) SC-DR-72-0523, Empirical Equations for Predicting Penetration Performance in Layered Earth Materials for Complex Penetrator Configurations, C.W. Young. The "soil equations" in this reference were used in all target geologies, except for the case with the concrete surface layer. See the minutes to the Phase 2 meeting on 13 January 1988 for penetration of thin concrete layer.

SURFACE PENETRATION IS A CONCERN AT CERTAIN TARGETS

- * In urban areas
 - Buildings or competent rubble may cause high structural loads; however
 - Reliable penetration of pavement and incompetent rubble may be possible by slowing down weapon
 - Sufficient open areas may be available for targeting purposes

- * At targets where competent rock is near the surface
 - Penetration may result in excessive loads unless the weapon is slowed down

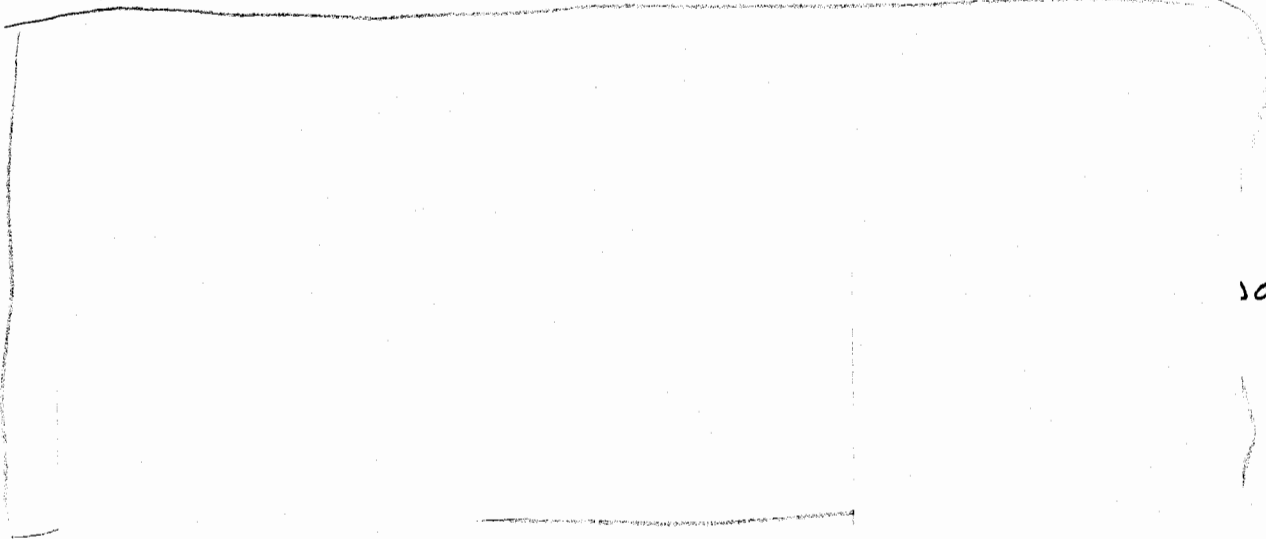
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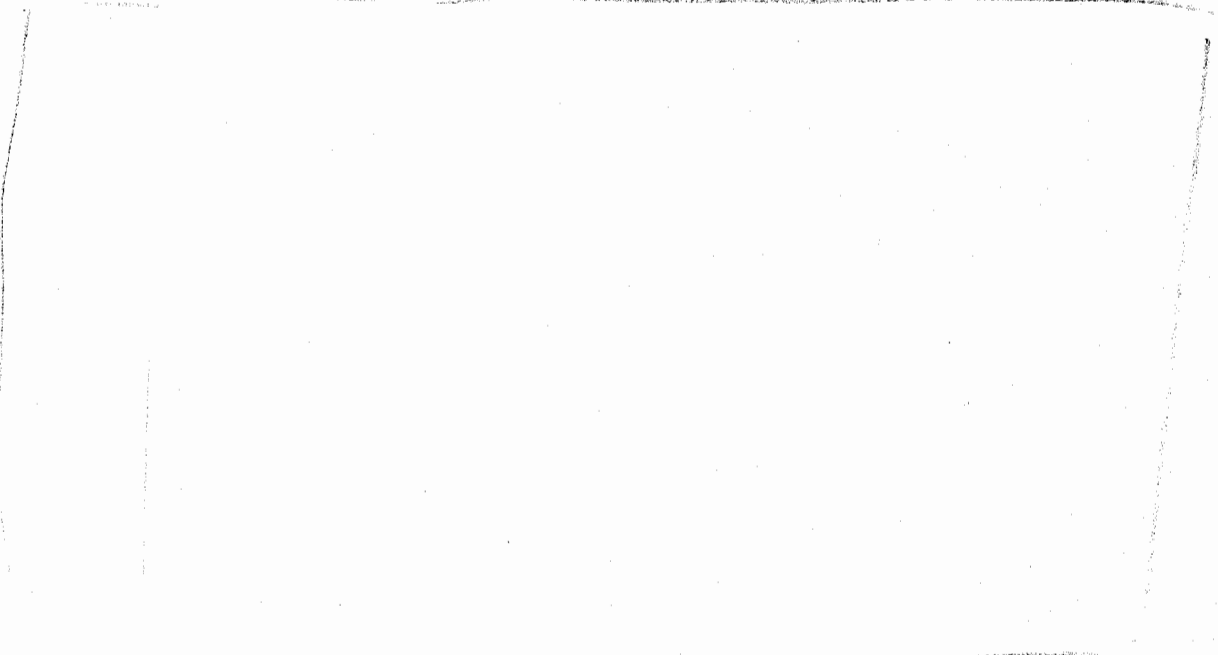
VG 9. (U) We used impact velocities expected to meet operational and penetrator-survival requirements.



soe b(c)

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(2)

WE USED IMPACT VELOCITIES EXPECTED TO MEET OPERATIONAL AND PENETRATOR-SURVIVAL REQUIREMENTS



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VG 9a. (U) "Depth of Penetration and Maximum Decelerations etc".

(U) This vugraph is a table of the DOBs, in meters, and the maximum decelerations, in g's, that each of the six EPWs would experience penetrating four generic target geologies with the appropriate impact velocity indicated in vugraph 9. These values were predicted by the Young/SMLA methodology.

DEPTH OF PENETRATION AND MAXIMUM DECELERATIONS
FOR INTERIM - SOLUTION EPWs

Depth of Penetration (m)/Maximum Deceleration (g)

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DOB
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XII. APPENDIX D
NUCLEAR SAFETY THEMES

1.

[redacted]
[redacted]
The complete safety theme for the [redacted] is provided in

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DOE
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reexamined below to assess the effect of this modification as well as the effect of replacing the radar nose section and the aluminum center case section with an integral steel case.

The implications of this new application of a [redacted] on the safety theme require examination of the following system characteristics:

Delivery Vehicle.

DOE
b(1)

[redacted]

DOE
b(3)

Warhead Electrical Inputs. Most electrical inputs to the

Delivery Vehicle. The [redacted] was designed for use as an aircraft delivered gravity device and has been evaluated for response to aircraft accident scenarios. [redacted]

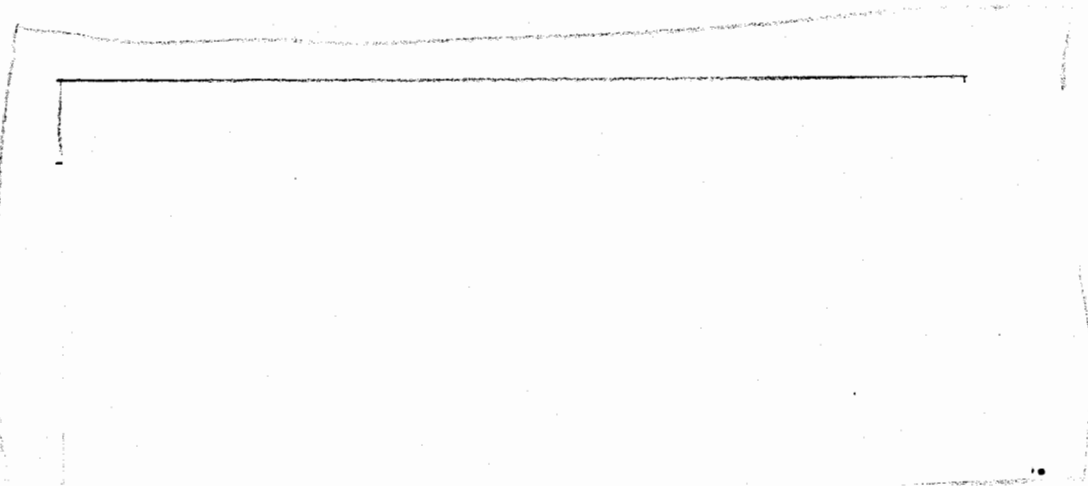
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Neither of these subsystems development programs require integration with the interim penetrator.

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3. Joint Test Program.

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DOE
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All tests will be joint DOE/contractor tests.

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The electromagnetic environments (EMR and EMP) will be covered in a ground test.

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The design demonstration will be the only tests involving detonation of the warhead high explosives.

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XIV. APPENDIX F
PENETRATION DEMONSTRATION TESTS

A.

A total of four tests have been conducted.

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A total

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1. Test Unit Description.

In the first three tests, a [] centercase was modified to accept a steel penetrator nose in place of the conventional

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Figure F2. Recovery Operation for Hellbender III

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2.5 Environmental and Vulnerability Considerations. The warhead shall survive, without reduction of specified design reliability or safety, the normal logistical and operational environments delineated in the Stockpile-to-Target Sequence (STS).

2.6 Reliability Considerations. The warhead shall have a reliability of TBD for all normal environments as defined in the Stockpile to Target Sequence (STS).

2.7 Safety Considerations. The warhead nuclear safety objectives require positive measures to prevent accidental or inadvertent arming and firing.

2.7.1 In the event of a detonation initiated at any one point in the warhead high explosive, the probability of achieving a nuclear yield greater than the energy equivalent of four pounds of TNT shall not exceed one in a million (1 in 10^6).

2.7.2 The probability of a premature nuclear detonation of the warhead for the normal logistical and operational environments described in the STS shall not exceed:

2.7.2.1 After stockpile entry, but prior to authorized prearm of the warhead (as defined in the STS), and in the absence of warhead initial enabling stimuli*, warhead final enabling stimuli*, and warhead battery initiate signal, 1 in 10^9 per warhead lifetime.

* Warhead enabling stimuli generally are unique signals and/or unique environments that operate

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2.7.4 All warhead external connectors will be designed to accept and be provided with seal protected caps which preclude introduction of signals into the warhead without breaking of the seal and removal of the cap.

2.7.5 The warhead design shall:

2.7.5.1 Following DoD/DOE coordinated render safe procedures, the warhead shall meet the requirements of 2.7.3.

2.7.5.2 Minimize personnel exposure to radiological, high explosive, chemical toxicity or other hazards during maintenance, handling, and other operations in normal environments. High explosive and radiological hazards to personnel should be minimized when the warhead is subjected to abnormal environments.

2.7.6 Upon removal of the arming signal(s) to the main firing set, the firing set shall automatically revert to a safe condition within 10 minutes.

2.7.7 Warhead arrays shall remain subcritical in all planned operational configurations and under accident situations stated in the STS.

2.7.8 The intrinsic radiation output of the warhead shall be as low as reasonably achievable to minimize hazards to personnel during all phases of the STS. A desired goal, based on joint DoD/DOE weapon system tradeoff studies, is no more than TBD millirem per hour (mrem/h) total with no more than (TBD) mrem/h resulting from neutrons and measured at a distance of 1 m from the centerline of the warhead. The DOE shall provide the DoD with details of the intrinsic radiation output of the warhead as specified by project officer's group.

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2.7.9 War reserve warheads will be identified with permanent and integral markings.

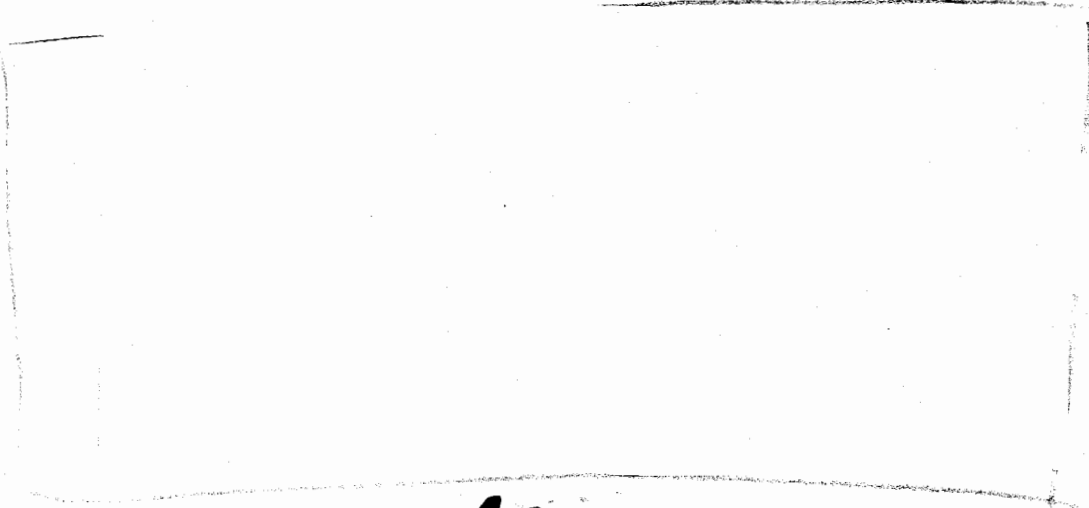
2.8 Maintenance and Equipment Considerations.

2.8.1 It is desired that the warhead require no maintenance or functional checking during the period between limited life component replacements. If maintenance or checking is necessary, the warhead shall be designed to permit accomplishment of these tasks while loaded on the launch platform, while in storage, or at Service Storage Facilities or their equivalent by qualified DoD personnel and shall require a minimum of time and specialized tools and equipment.

2.8.2 DOE supplied equipment to be used with this warhead will be capable of withstanding the same environmental conditions required of the warhead in areas where they are to be used together.

2.8.3 The warhead shipping and storage container shall be compatible with present military transportation systems and handling and storage procedures as described in the STS.

2.9 Command and Control



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XVI. ACRONYMS AND TERMS

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EMP	Electromagnetic Pulse
EMR	Electromagnetic Radiation
EPW	Earth Penetrating Weapon
ESD	Environmental Sensing Device
ICU	Interface Control Unit
IHE	Insensitive High Explosive
IMF	Integrated Maintenance Facility
JTA	Joint Test Assembly
MIU	Missile Interface Unit
MMII	Minuteman II Missile
OAS	Offensive Avionics System
OSD	Office of the Secretary of Defense
OST	Operational Suitability Test
PTP	Probability to Penetrate (defenses)
RV	Reentry Vehicle
REG	Retarded Ground
SAC	Strategic Air Command
S&TNF	Strategic & Theater Nuclear Forces
STS	Stockpile-To-Target Sequence

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